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Dietary Fats and Health

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Terminology

Lipid is the general term for fats. About 95 percent of fats in the body and in foods are triglycerides, compounds of glycerol with three fatty acids attached. The chemical structure of the glycerol is always the same, but many different fatty acids can be attached to the glycerol. Fatty acids differ from each other in two ways: chain length and degree of saturation. The most common fatty acids in foods have a chain length of 16 or 18 carbon atoms.

Also, fatty acids can be either "saturated" or "unsaturated" with hydrogen. Saturated fatty acids contain all the hydrogen they can hold and no double bonds. Unsaturated fatty acids contain one or more double bonds; a monounsaturated fatty acid has one double bond and a polyunsaturated fat has two or more. The mix of saturated, monounsaturated, and polyunsaturated fatty acids in various products appears in table 1.

Most food fats are a combination of saturated and unsaturated fatty acids. Plant seeds and fish oils are the best sources of polyunsaturated fatty acids. Although fatty acids from plant sources are generally unsaturated, the fatty acids in coconut and palm oils are highly saturated.

To complicate the issue, manufacturers often add hydrogen to vegetable oils. The process of adding hydrogen to a double bond in an unsaturated fatty acid to make it more saturated is called hydrogenation. The hydrogenation process is apparent in margarines. The harder the margarine, the more it's been hydrogenated.

The hydrogenation process produces some unsaturated fatty acids that are structurally different from naturally occurring unsaturated fatty acids. These fatty acids are called "trans" fatty acids in contrast to the naturally occurring "cis" form. It is not currently known whether trans fatty acids are metabolized the same as cis fatty acids in the body. Trans fatty acids have been implicated as a potential risk for atherosclerosis but additional studies are needed to clarify what metabolic differences exist between cis and trans fatty acids.

Why differentiate between saturated and unsaturated fatty acids?

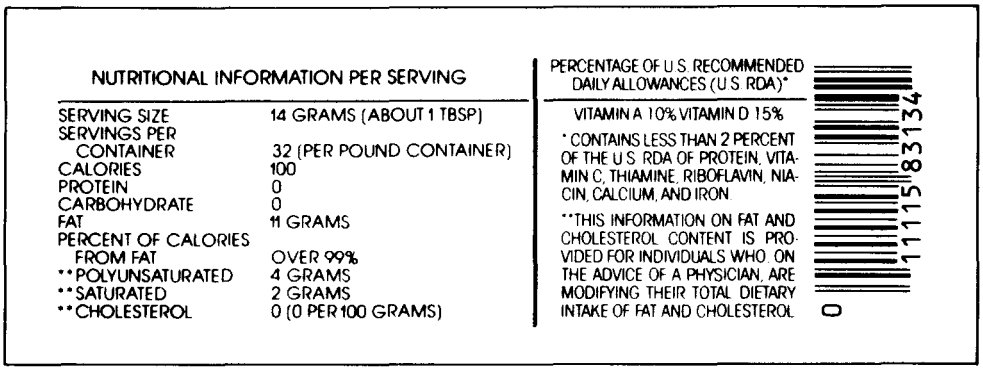
Two reasons. First, the saturation of a fatty acid determines its physical properties. Unsaturated fatty acids have lower melting points and are liquids such as corn oil and sunflower oil. Animal products, such as lard and butter, contain more saturated fatty acids and are solid at room temperature. As vegetable oils are hydrogenated or made more saturated, they become harder.

Second, for health reasons. "Nutrition and Your Health: Dietary Guidelines for Americans" (USDA, DHEW, 1980) recommends reducing the saturated fat content of the diet. This is because saturated fats raise blood cholesterol. Polyunsaturated fats reduce blood cholesterol while monounsaturates do not seem to affect blood cholesterol. Elevated blood cholesterol is a risk factor in the development of cardiovascular disease. To reduce the saturated fat content of our diet, we must know where saturated fats appear in the food supply.

Manufacturers who make nutritional claims for a product are required to supply information about its fat con-

Table 1.

Food	Fatty acids		
	Saturated	Mono-unsaturated	Poly-unsaturated
	..... percent		
Salad oils			
Safflower	9	12	74
Sunflower	10	21	64
Corn	13	25	58
Sesame	15	40	40
Soybean, hydrogenated (common cooking oil)	15	43	37
Peanut	17	47	31
Olive	14	72	9
Palm	48	38	9
Coconut	86	6	2
Vegetable shortening	25	44	26
Margarine, stick, corn oil	14	30	32
Butter	50	23	3
Chicken fat	32	45	18
Lard	40	44	12
Beef tallow	48	42	4
Tuna	2	2	3
Salmon	2	2	5
Pecans	6	43	18
Peanuts	9	24	13
Egg yolk	10	13	4
Avocado	2	9	2



NUTRITIONAL INFORMATION PER SERVING

SERVING SIZE	14 GRAMS (ABOUT 1 TBSP)
SERVINGS PER CONTAINER	32 (PER POUND CONTAINER)
CALORIES	100
PROTEIN	0
CARBOHYDRATE	0
FAT	11 GRAMS
PERCENT OF CALORIES FROM FAT	OVER 99%
**POLYUNSATURATED	4 GRAMS
**SATURATED	2 GRAMS
**CHOLESTEROL	0 (0 PER 100 GRAMS)

PERCENTAGE OF U.S. RECOMMENDED DAILY ALLOWANCES (U.S. RDA)*

VITAMIN A 10% VITAMIN D 15%

* CONTAINS LESS THAN 2 PERCENT OF THE U.S. RDA OF PROTEIN, VITAMIN C, THIAMINE, RIBOFLAVIN, NIACIN, CALCIUM, AND IRON.

**THIS INFORMATION ON FAT AND CHOLESTEROL CONTENT IS PROVIDED FOR INDIVIDUALS WHO, ON THE ADVICE OF A PHYSICIAN, ARE MODIFYING THEIR TOTAL DIETARY INTAKE OF FAT AND CHOLESTEROL.

Margarine label

LIQUID SUNFLOWER OIL, PARTIALLY HYDROGENATED SOYBEAN OIL, WATER, PARTIALLY HYDROGENATED COTTONSEED OIL, SALT, WHEY, VEGETABLE MONO AND DIGLYCERIDES, VEGETABLE LECITHIN, SODIUM BENZOATE AS A PRESERVATIVE, POTASSIUM CASEINATE (A PROTEIN), ARTIFICIALLY FLAVORED, COLORED WITH BETA CAROTENE, VITAMINS A (PALMITATE) AND D (CALCIFEROL) ADDED.

Ingredient list

tent. This margarine label shows 1 serving contains 4 grams of polyunsaturated fat and 2 grams of saturated fat. You can calculate the polyunsaturated to saturated ratio (P/S:) as 4/2 = 2. The prudent diet recommended by the American Heart Association suggests a P/S ratio of from 0.7 to 2.5.

Beef, butter, and coconut oil, have a low P/S ratio while non-hydrogenated vegetable oils have a high P/S ratio (table 1). The manufacturer must supply values for saturated and unsaturated fatty acids in order for you to calculate the P/S ratio. An ingredient list (see example) does not give sufficient information to estimate the P/S ratio.

Is it necessary to include fat in the diet?

Yes. Polyunsaturated fats are the source of the essential fatty acid lineoleic acid, needed for normal growth. Essential fatty acids must be supplied in the diet because the body cannot make them. But, only a small amount of vegetable oil is needed to supply the essential fatty acids. Fats and oils also are carriers of the fat soluble vitamins, A, D, E, and K.

Unfortunately for many of us, fat is also an excellent source of calories. Fats supply 9 calories per gram compared with 4 calories per gram for protein and carbohydrate. In addition, fats slow down digestion and therefore are more filling than carbohydrates or proteins. Also, fats are responsible for the flavors and textures in foods.

Which foods contribute fat to the diet?

Most foods contain fat but the amount varies greatly. Dietary fats are either "visible" or "invisible." Invisible fats are found in meats, cheese, eggs, and whole milk. The following table shows that many foods not thought of as "greasy" contain significant amounts of fat.

Fruits and vegetables are generally low in fat. Methods of food preparation, sauces, and other toppings can add significant fat to the diet.

How much fat do we eat and how much should we eat?

The amount of edible fat available for consumption has increased significantly during this century, as has the proportion of calories derived from fat. Currently, about 42 percent of our calories come from fat. Most experts agree that no more than 35 percent of calories should come from fat and some scientists feel fat intake should be reduced even further. Because fat is a high caloric nutrient and many Americans are overweight, cutting fat in the diet can help control calories and may help prevent certain diseases.

Table 2.

Food	Calories from fat
Dairy Products	percent
Whole milk	48
Skim milk	0
Cheddar cheese	70
Ice cream, rich	62
Meats (cooked)	
Hot dogs	79
Hamburger, 21% fat	65
Lean beef (round)	22
Pork chops, lean only	54
Broiled chicken breast	26
Bacon	85
Other	
French fries	47
Doughnuts, cake	45
Peanut butter	76
Milk chocolate bar	56

What lipids besides triglycerides should we know about?

Other members of the lipid family are the phospholipids and the sterols. Lecithin and other phospholipids play important roles in the construction of cell membranes. Lecithin is widespread in foods and made abundantly by the body. It is not an essential nutrient and does not need to be taken as a supplement.

The sterol cholesterol is in every cell in the body. Cholesterol can be made by the body and it can be obtained in food eaten. Cholesterol also forms the major part of the plaques that narrow body arteries in the disease atherosclerosis.

What are the richest dietary sources of cholesterol?

Organ meats such as liver and kidney are especially high in cholesterol (table 3). Plant foods do not contain cholesterol. A single egg contains 250 milligrams of cholesterol and shellfish such as shrimp are also rich sources.

Should we worry about the cholesterol content of foods?

The current intake of cholesterol by the U.S. population averages 450 milligrams per day. The Select Committee on Nutrition and Human Needs of the U.S. Senate recommended in the Dietary Goals a reduction to about 300 milligrams of cholesterol per day.

High blood cholesterol is a risk factor in developing coronary heart disease. But, heredity, gender, exercise, stress, and cigarette smoking also affect blood cholesterol. And, not all blood cholesterol is the same. Total blood cholesterol is distributed among three classes of lipoproteins which transport cholesterol within the body. These lipoproteins are called very low density lipoproteins (VLDL), low density lipoproteins (LDL), and high density lipoproteins (HDL). Different lipoproteins have different risk factors for coronary heart disease. VLDL is a neutral risk factor, high LDL is a positive risk factor, and high HDL is a negative risk factor (protective against development of heart disease). HDL levels are higher in women and athletes which is consistent with the lower incidence of atherosclerosis in these two groups.

Should we modify the kinds and amounts of fat in the diet to prevent disease?

Populations which consume high fat diets have a higher incidence of heart disease, certain cancer, diabetes, and other degenerative diseases. Atherosclerosis in the United States is the leading cause of death. Statistically speaking, the higher the blood cholesterol, the more likely the chance of developing heart disease. A high intake of saturated fat is a major factor in elevating blood cholesterol while a high intake of polyunsaturated fatty acids is important in lower blood cholesterol. Dietary cholesterol has less effect on blood cholesterol.

Recent data show an inverse relationship between blood cholesterol and cancer risk. Persons with low blood cholesterol have a higher incidence of cancer. Epidemiological studies show that the risk of coronary heart disease increases markedly at high blood cholesterol levels while the risk of colon cancer in men increases when blood cholesterol is low.

The Dietary Guidelines state "for the U.S. population as a whole, reduction in our current intake of total fat, saturated fat, and cholesterol is sensible. This suggestion is especially appropriate for people who have high blood pressure or who smoke." Dietary recommendations from other agencies disagree on how much and what kind of fat to include in the diet. But, all agencies agree: consume a variety of foods in moderate amounts and maintain appropriate body weight. Consumption of moderate amounts of dietary fats within a balanced diet would be a safe recommendation.

Table 3.

Food	Amount	Cholesterol (milligrams)
Milk, skim, fluid or reconstituted dry	1 cup	5
Lard	1 tablespoon	12
Cottage cheese, creamed	½ cup	24
Cream, half and half	¼ cup	26
Ice cream, regular, approx. 10% fat	½ cup	27
Cheese, cheddar	1 ounce	28
Milk, whole	1 cup	34
Butter	1 tablespoon	35
Oysters, salmon	3 ounces, cooked	40
Clams, halibut, tuna	3 ounces, cooked	55
Chicken, turkey, light meat	3 ounces, cooked	67
Beef, pork, lobster, chicken, turkey, dark meat	3 ounces, cooked	75
Lamb, veal, crab	3 ounces, cooked	85
Shrimp	3 ounces, cooked	130
Heart, beef	3 ounces, cooked	230
Egg	1 yolk or 1 egg	250
Liver, beef, calf, hog, lamb	3 ounces, cooked	370
Kidney	3 ounces, cooked	680
Brains	3 ounces, raw	more than 1700

Source: "Cholesterol Content of Foods," R.M. Feeley, P.E. Criner, B.K. Watt. Journal of American Dietetics Assn. 61:134, 1972.

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